

PATENT ABSTRACTS OF JAPAN

(11)Publication number.: 06-232038

(43)Date of publication of application : 19.08.1994

(51)Int.Cl.

H01L 21/027

B05C 11/08

G03F 7/16

(21)Application number : 05-018314

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(22)Date of filing : 05.02.1993

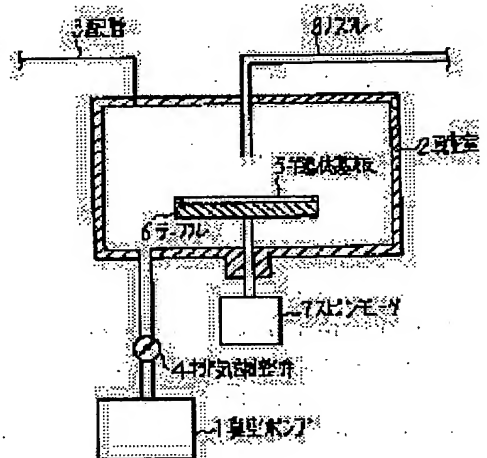
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(54) ROTARY COATING DEVICE

(57)Abstract:

PURPOSE: To prevent the occurrence of such a case that a recessed section on a semiconductor substrate is not filled up with an applied liquid and bubbles remain in the applied film or the applied film is stripped off due to the swelling of bubbles in a succeeding process at the time of applying the liquid in a rotating state.

CONSTITUTION: The device is provided with a vacuum chamber 2 having a closed space for enclosing a semiconductor substrate 5 and the atmosphere around the substrate 5 is reduced to the atmospheric pressure after applying a liquid by rotating the substrate 5 while the inside of the chamber 2 is maintained at a fixed pressured-reduced state by using an inert gas supplied from a pipeline 3 and exhaust regulating valve 4 so that even the recessed section of a fine pattern can be filled up with the applied liquid and no bubble can be generated in the applied film.



LEGAL STATUS

[Date of request for examination] 28.03.1997

[Date of sending the examiner's decision of rejection] 12.10.1999

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

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CLAIMS

[Claim(s)]

[Claim 1] The table which puts in and lays a semi-conductor substrate in a hollow, and the spin motor which rotates this table, The closing space which wraps a part for the tip of the nozzle which trickles coating liquid into said semiconductor memory, and a said semi-conductor substrate and said table, and said nozzle *****, It has the exhaust air regulator valve which controls the gas pressure which collaborates with the vacuum pump which decompresses this vacuum chamber, and this vacuum pump, and is introduced into said vacuum chamber. The rotation coater characterized by dropping coating liquid from said nozzle where gas pressure of said vacuum chamber is made small, rotating said table, extending the dropping **** aforementioned coating liquid to said semi-conductor substrate, and returning the appropriate account vacuum chamber of back to front to atmospheric air.

[Claim 2] The rotation coater according to claim 1 with which said gas introduced is characterized by evaporating the solvent of said coating liquid.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] It is related with the rotation coater which forms the spreading film on a detailed pattern especially by the semi-conductor production process about the rotation coater of this invention.

[0002]

[Description of the Prior Art] Drawing 4 is drawing showing the outline in an example of the conventional rotation coater. The conventional rotation coater had the chuck 13 which adsorbs the semi-conductor substrate 5 and rotates, the spin motor 7 which rotates a chuck 13, the nozzle 5 which trickles coating liquid, and the cup 12 which involutes a chuck 13 and collects coating liquid, as shown in drawing 4.

[0003] When using this rotation coater and forming the spreading film in the semi-conductor substrate 5, a chuck 13 is made to carry out adsorption maintenance of the semi-conductor substrate 5. Next, from a nozzle 8, coating liquid is dropped at a semi-conductor substrate, and the semi-conductor substrate 5 is rotated by the spin motor 7. As for the coating liquid trickled by this, the breadth spreading film is formed in semi-conductor substrate 5 front face of a centrifugal force.

[0004] Thus, where whenever [viscosity / of the amount of coating liquid dropped and coating liquid] is able to be balanced using a rotation centrifugal force, the spreading film of predetermined thickness was formed.

[0005]

[Problem(s) to be Solved by the Invention] However, the spreading side of a semi-conductor substrate is not necessarily uniform, and is irregular beforehand with a formation **** pattern. When there is such irregularity, to

the bottom of the crevice, coating liquid is not prudent and it often remains as air bubbles. And the air bubbles left behind according to the next semi-conductor substrate heating process swelled, peeling of the spreading film was caused, and there was a trouble that the pattern currently formed on the semi-conductor substrate will collapse.

[0006] Therefore, the purpose of this invention is offering the rotation coater which can form the spreading film by uniform thickness, without breaking down a pattern.

[0007]

[Means for Solving the Problem] The table which the description of this invention puts a semi-conductor substrate into a hollow, and is laid, and the spin motor which rotates this table, The closing space which wraps a part for the tip of the nozzle which trickles coating liquid into said semiconductor memory, and a said semi-conductor substrate and said table, and said nozzle *****, It has the exhaust air regulator valve which controls the gas pressure which collaborates with the vacuum pump which decompresses this vacuum chamber, and this vacuum pump, and is introduced into said vacuum chamber. It is the rotation coater which trickles coating liquid from said nozzle where gas pressure of said vacuum chamber is made small, rotates said table, extends the dropping **** aforementioned coating liquid to said semi-conductor substrate, and returns the appropriate account vacuum chamber of back to front to atmospheric air.

[0008]

[Example] Next, this invention is explained with reference to a drawing.

[0009] Drawing 1 is drawing showing the outline of the rotation coater of one example of this invention. This rotation coater is equipped with the exhaust air regulator valve 4 which adjusts the vacuum chamber 2 which forms the space which wraps the table 6 which lays the semi-conductor substrate 5, and the arrow edge and table 6 of a nozzle 8, the vacuum pump 1 which carries out evacuation of this vacuum chamber 2, the piping 3 which introduces inert gas into a vacuum chamber 2, and the pressure of a vacuum chamber 2 as shown in drawing 1.

[0010] Next, actuation of this rotation coater is explained. First, the semi-conductor substrate 5 is put on a table 6. Since a table 6 has a hollow at this time, it lays so that the semi-conductor substrate 5 may enter this hollow. Next, the inlet port of a vacuum chamber 2 is closed and evacuation of the vacuum chamber 2 is carried out with a vacuum pump 1. Next, if a vacuum chamber 2 **** to a predetermined degree of vacuum, inert gas will be introduced from piping 3. And the opening of the exhaust air regulator valve 4 is adjusted, and the inactive gas pressure of a vacuum chamber 2 is maintained at a fixed reduced pressure condition. Next, a table 6 is rotated by the spin motor 7, and coating liquid is dropped at the semi-conductor substrate 5 from a nozzle 8.

[0011] Next, when coating liquid spreads uniformly in the field of the semi-conductor substrate 5, a vacuum pump 1 is suspended and the exhaust air regulator valve 4 is closed. Inert gas continues feeding by this and a vacuum chamber 2 is returned to atmospheric pressure. The semi-conductor substrate 5 is taken out for rotation of a table 6 from the inlet port of the vacuum chamber 2 of a stop and a vacuum chamber 2.

[0012] Drawing 2 is a graph which shows the rate of gassing by equipment and the equipment of this invention conventionally. When the spreading film was formed in the semi-conductor substrate with which the contact hole was formed in the attempt and equipment and the equipment of this invention compared the rate of gassing conventionally, as shown in drawing 2, conventionally, according to the equipment of this invention, with equipment, it was not based on the depth of a contact hole to that of ***** two-dimensional, so that the depth of a contact hole was deep, but there was no generating of air bubbles.

[0013] Drawing 3 is drawing showing the outline of the rotation coater of other examples of this invention. This rotation coater is having formed the solvent tank 9 which is the solvent of coating liquid, the carburetor 10 which evaporates a solvent, and the massflow controller 11 which adjusts the flow rate of the solvent gas evaporated in piping 3, as shown in drawing 3. It is the same as the above-mentioned example except it.

[0014] After actuation of this rotation coater decompresses the vacuum chamber 2 which contained the semi-conductor substrate 5, it controls a flow rate by the massflow controller 11, and introduces the solvent gas from a carburetor 10 into a vacuum chamber 2, and makes a vacuum chamber 2 a fixed reduced pressure condition by the gas and the exhaust air regulator valve 4 of a solvent, and performs rotation spreading in this condition.

[0015] In this example, since the gas of a solvent serves as a spreading ambient atmosphere, the viscosity of coating liquid is kept low that the solvent in coating liquid cannot evaporate easily, and there is an advantage on which **** can form ** and the spreading film of uniform thickness uniformly on the semi-conductor substrate 5.

[0016]

[Effect of the Invention] The vacuum chamber in which this invention has package closing space for the semi-

conductor substrate which should be applied as explained above, By establishing the evacuation means which changes this vacuum chamber into a reduced pressure condition, and the gas supply means returned to atmospheric pressure, dropping coating liquid, applying the ambient atmosphere of said closing space in the state of reduced pressure, and returning an ambient atmosphere to atmospheric pressure after an appropriate time Coating liquid is enough buried to the crevice of the detailed pattern of a semi-conductor substrate, and air bubbles are not made into the spreading film, but it is effective in the spreading film not separating, even if it heats a semi-conductor substrate at a process after spreading.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is drawing showing the outline of the rotation coater of one example of this invention.

[Drawing 2] It is the graph which shows the rate of gassing by equipment and the equipment of this invention conventionally.

[Drawing 3] It is drawing showing the outline of the rotation coater of other examples of this invention.

[Drawing 4] It is drawing showing the outline of the rotation coater in a conventional example.

[Description of Notations]

- 1 Vacuum Pump
 - 2 Vacuum Chamber
 - 3 Piping
 - 4 Exhaust Air Regulator Valve
 - 5 Semi-conductor Substrate
 - 6 Table
 - 7 Spin Motor
 - 8 Nozzle
 - 9 Solvent Tank
 - 10 Carburetor
 - 11 Massflow Controller
 - 13 Check
-

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(19)日本国特許庁(J P)

(12) 公開特許公報(A)

(11)特許出願公開番号

特開平6-232038

(43)公開日 平成6年(1994)8月19日

(51)Int.Cl. ⁵	識別記号	庁内整理番号	F I	技術表示箇所
H 0 1 L 21/027				
B 0 5 C 11/08		6804-4D		
G 0 3 F 7/16	5 0 2	7352-4M	H 0 1 L 21/ 30	3 6 1 C
審査請求 未請求 請求項の数 2 O L (全 4 頁)				

(21)出願番号 特願平5-18314

(22)出願日 平成5年(1993)2月5日

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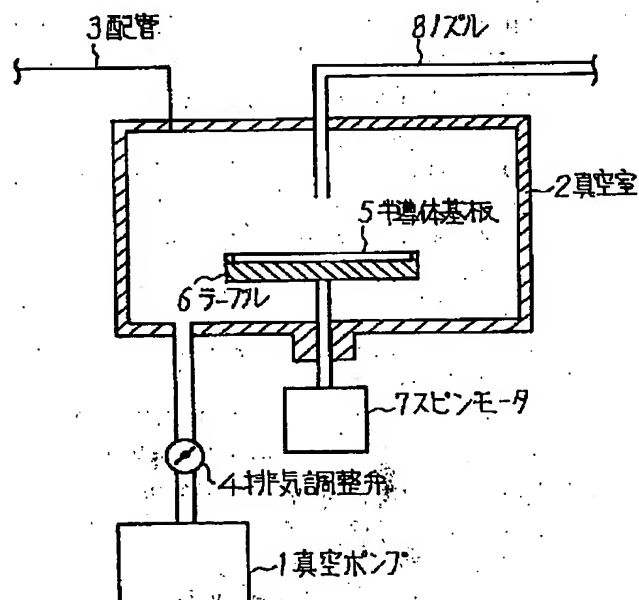
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(54)【発明の名称】 回転塗布装置

(57)【要約】

【目的】回転塗布を行う場合に、半導体基板上の凹部まで塗布液が埋まらず、気泡が塗布膜に残ったり、後工程で加熱されることにより気泡が膨らみ塗布膜の剥れが発生するのを防止する。

【構成】半導体基板を包む閉鎖空間をもつ真空室2を設け、配管3から供給される不活性ガスと排気調整弁4にて真空室2内を一定の減圧状態にし、この状態で回転塗布を行い塗布した後に半導体基板5の雰囲気気を大気圧に戻すことにより、微細パターンの凹部まで塗布液を埋め、塗布膜中に気泡が発生することを防止している。



(2)

【特許請求の範囲】

【請求項1】 半導体基板を窪みに入れ載置するテーブルと、このテーブルを回転させるスピンドルモータと、前記半導体記憶装置に塗布液を滴下するノズルと、前記半導体基板と前記テーブル及び前記ノズルの先端分を包む閉鎖空間をつ真空室と、この真空室を減圧する真空ポンプと、この真空ポンプと協働して前記真空室に導入されるガス圧を制御する排気調整弁とを備え、前記真空室のガス圧を小さくした状態で前記ノズルより塗布液を滴下し、前記テーブルを回転し滴下した前記塗布液を前記半導体基板に引き伸ばし、しかる後前記真空室を大気に戻すことを特徴とする回転塗布装置。

【請求項2】 前記導入されるガスが前記塗布液の溶剤が気化されたものであることを特徴とする請求項1記載の回転塗布装置。

【発明の詳細な説明】

【0001】

【産業上の利用分野】本発明の回転塗布装置に関し、特に半導体製造工程で微細パターン上に塗布膜を形成する回転塗布装置に関する。

【0002】

【従来の技術】図4は従来の回転塗布装置の一例における概略を示す図である。従来の回転塗布装置は、図4に示すように、半導体基板5を吸着し回転するチャック13とチャック13を回転させるスピンドルモータ7と、塗布液を滴下するノズル5と、チャック13を包含し塗布液を溜めるカップ12を有していた。

【0003】この回転塗布装置を使用して、半導体基板5に塗布膜を形成する場合は、チャック13に半導体基板5を吸着保持させる。次に、ノズル8より塗布液を半導体基板に滴下し、スピンドルモータ7により半導体基板5を回転させる。このことにより滴下された塗布液は遠心力により半導体基板5表面に広がり塗布膜が形成される。

【0004】このように、回転遠心力を利用して、滴下される塗布液量と塗布液の粘性度のバランスのとれた状態で所定膜厚の塗布膜を形成していた。

【0005】

【発明が解決しようとする課題】しかしながら、半導体基板の塗布面は必ずしも一様でなく、予め形成れたパターンにより凹凸がある。このような凹凸がある場合には、その凹部の底まで塗布液が行届かず、しばしば気泡として残る。そして、この後の半導体基板加熱工程により残された気泡が膨らみ、塗布膜の剥れを起し、半導体基板上に形成されていたパターンがくずれてしまうという問題点があった。

【0006】従って、本発明の目的は、パターンをくずすことなく一様の膜厚で塗布膜が形成出来る回転塗布装置を提供することである。

【0007】

【課題を解決するための手段】本発明の特徴は、半導体基板を窪みに入れ載置するテーブルと、このテーブルを回転させるスピンドルモータと、前記半導体記憶装置に塗布液を滴下するノズルと、前記半導体基板と前記テーブル及び前記ノズルの先端分を包む閉鎖空間をつ真空室と、この真空室を減圧する真空ポンプと、この真空ポンプと協働して前記真空室に導入されるガス圧を制御する排気調整弁とを備え、前記真空室のガス圧を小さくした状態で前記ノズルより塗布液を滴下し、前記テーブルを回転し滴下した前記塗布液を前記半導体基板に引き伸ばし、しかる後前記真空室を大気に戻す回転塗布装置である。

【0008】

【実施例】次に、本発明について図面を参照して説明する。

【0009】図1は本発明の一実施例の回転塗布装置の概略を示す図である。この回転塗布装置は、図1に示すように、半導体基板5を載置するテーブル6と、ノズル8の先端部及びテーブル6を包む空間を形成する真空室2と、この真空室2を真空排気する真空ポンプ1と、真空室2に不活性ガスを導入する配管3と、真空室2の圧力を調節する排気調整弁4を備えている。

【0010】次に、この回転塗布装置の動作を説明する。まず、テーブル6に半導体基板5を乗せる。このときテーブル6は窪みがあるので、この窪みに半導体基板5が入り込むように載置する。次に、真空室2の入口を閉じ、真空ポンプ1で真空室2を真空排気する。次に、真空室2が所定の真空度に達したら、配管3から不活性ガスを導入する。そして、排気調整弁4の開度を調整して真空室2の不活性ガス圧を一定の減圧状態に保つ。次に、スピンドルモータ7によりテーブル6を回転させ、ノズル8より塗布液を半導体基板5に滴下する。

【0011】次に、塗布液が半導体基板5の面に一様に広がった時点で、真空ポンプ1を停止し、排気調整弁4を閉じる。このことにより不活性ガスが送給し続け、真空室2を大気圧に戻す。テーブル6の回転を止め、真空室2の真空室2の入口から半導体基板5を取出す。

【0012】図2は従来装置と本発明の装置による気泡発生率を示すグラフである。試みにコンタクト穴が形成された半導体基板に塗布膜を形成し、従来装置と本発明の装置とで気泡発生率を比較したところ、図2に示すように、従来装置ではコンタクト穴の深さが深い程、2次元的に増加すのに対し、本発明の装置によれば、コンタクト穴の深さによらず気泡の発生は皆無であった。

【0013】図3は本発明の他の実施例の回転塗布装置の概略を示す図である。この回転塗布装置は、図3に示すように、配管3に塗布液の溶剤である溶剤タンク9と、溶剤を気化する気化器10と、気化される溶剤ガスの流量を調整するマスフローコントローラ11を設けたことである。それ以外は前述の実施例と同じである。

【0014】この回転塗布装置の動作は、半導体基板5

(3)

を収納した真空室2を減圧した後に、気化器10からの溶剤ガスをマスフローコントローラ11にて流量を制御し真空室2に導入し、そして溶剤のガスと排気調整弁4により真空室2を一定の減圧状態としこの状態で回転塗布を行う。

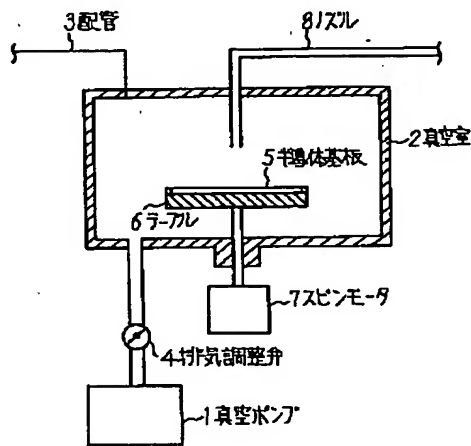
【0015】この実施例では溶剤のガスが塗布雰囲気となるため、塗布液中の溶剤が蒸発し難く塗布液の粘度が低く保たれ、半導体基板5上に一様に拡ろがり、均一な膜厚の塗布膜が形成できる利点がある。

【0016】

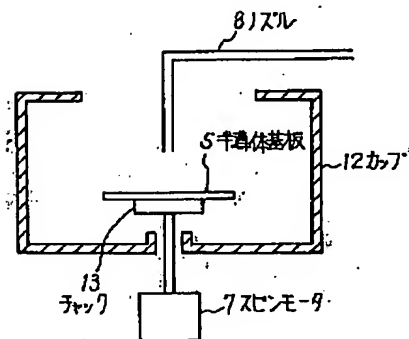
【発明の効果】以上説明したように本発明は、塗布すべき半導体基板を包み閉鎖空間をもつ真空室と、この真空室を減圧状態にする真空排気手段と、大気圧に戻すガス供給手段とを設け、前記閉鎖空間の雰囲気を減圧状態で塗布液を滴下して塗布し、しかる後に雰囲気を大気圧に戻すことにより、半導体基板の微細パターンの凹部まで塗布液が充分埋まり、塗布膜中に気泡が出来ず、塗布の後工程で半導体基板を加熱しても塗布膜が剥れないという効果がある。

【図面の簡単な説明】

【図1】本発明の一実施例の回転塗布装置の概略を示す



【図4】



4

図である。

【図2】従来装置と本発明の装置による気泡発生率を示すグラフである。

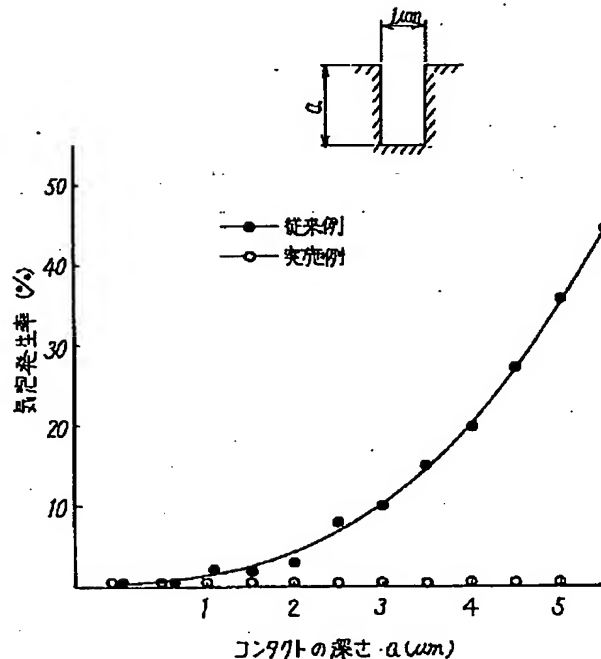
【図3】本発明の他の実施例の回転塗布装置の概略を示す図である。

【図4】従来の一例における回転塗布装置の概略を示す図である。

【符号の説明】

- | | |
|----|-------------|
| 1 | 真空ポンプ |
| 2 | 真空室 |
| 3 | 配管 |
| 4 | 排気調整弁 |
| 5 | 半導体基板 |
| 6 | テーブル |
| 7 | スピンドモータ |
| 8 | ノズル |
| 9 | 溶剤タンク |
| 10 | 気化器 |
| 11 | マスフローコントローラ |
| 13 | チェック |

【図2】



(4)

【図3】

